ATM LOCATOR MOBILE APPLICATION

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ABSTRACT

Global Positioning System (GPS) is has been widely used in many fields. At first, it is used for the purpose of military forces needs. Then, the uses of GPS has extended into people's lifestyle, where they can use it for hiking purpose, as traveling direction, and etc. Besides that, it is useful for user to search for nearby amenities – restaurants, petrol stations, banks and more, especially for someone who is unfamiliar to new location. Therefore, the aim of this paper is to propose an ATM locator for mobile application. Developed methods are entirely mobile web-based. This system will instantly tells the user where does the closest ATM located from their current location. Hence, this system is developed slight similar to the existing system like Maybank ATM locator, where this proposed system can locate all kind of Bank company's ATM instead of only the Maybank ATM. Besides that, it is a hybrid mobile application. Hybrid app is a native, downloadable app and it uses both browser interfaces and native mobile components. With HTML5 and JavaScripts, the browsers are becoming capable of accessing a phone's built-in features like contacts, camera etc. In order to keep the timeline for this system to be finish at the appointed time. So, a System Development Life Cycle (SDLC) was referred.

ABSTRAK

Sistem Kedudukan Sejagat telah digunakan secara meluas dalam pelbagai bidang. Pada mulanya, tujuan sistem ini adalah untuk keperluan angkatan tentera. Kenudian, penggunaan sistem ini telah diperluaskan dalam gaya hidup rakyat, di mana mereka ianya digunakan untuk tujuan mendaki, sebagai perjalanan hulu tuju dan lain-lain. Selain daripada it, ianya amat berguna kepada pengguna terutamanya kepada mereka yang tidak biasa dengan tempat tersebut, bagi mencari kemudahan berdekatan seperti restorant, minyak station, bank dan sebagainya. Oleh itu, tujuan kertas ini ada untuk mencadangkan satu lokator ATM untuk aplikasi mudah alih. Kaedah yang digunakan bagi membangunkan sistem ini adalah berasaskan web. Sistem ini akan serta-merta memberitahu pengguna dimana ATM terdekat terletak dari lokasi semasa mereka. Oleh demikian itu, sistem ini dibangunkan seumpama kepada sistem yang sedia ada seperti ATM Maybank lokator, tetapi sistem yang dicadangkan ini boleh mengesan semua jenis ATM syarikat Bank bukan hanya ATM Maybank. Selain itu, ia adalah satu aplikasi mudah alih yang hibrid. Hibrid aplikasi asli adalah boleh dimuat turun dan ia menggunakan kedua-dua *browser* dan asli komponen mudah alih dalam antaramuka. Dengan menggunakan HTML5 dan JavaScripts, *browser* mampu mengakses ciri-ciri terbina dalam telefon seperti kenalan, kamera dan sebagainya. Dalam usaha untuk memastikan sistem ini tamat pada waktu yang ditetapkan dengan merujuk kepada System Development Life Cycle (SDLC).

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LIST OF ACRONYMS

GPS	Global Positioning System
LBS	Location-Based Service
ATM	Automated Teller Machine
U.S.	United State
SV	Satellite Vehicles
PRN	Pseudorandom Noise
DOP	Dilution Of Precision
PVT	Position, Velocity and Time
I/O	Input/Output
RAM	Random access memory
ICs	Integrated Circuits
FCC	Federal Communications Commission
PDA	Personal Digital Assistant
iOS	iPhone Operating System
M2U MAP	Maybank ATM and Bank Branch Locator
mLot	Toyota Shopping Tool
AT&T	American Telephone and Telegraph
SDK	Software Development Kit
CSS	Cascading Style Sheets
apps	Applications
APIs	Application Programming Interfaces
SDLC	System Development Life Cycle
HTML5	HyperText Markup Language
JSON	JavaScript Object Notation
AJAX	Asynchronous JavaScript and XML
COO	Cell of Origin
AOA	Angle of Arrival

TOA	Time of Arrival
EOTD	Enhanced Observed Time Difference
A-GPS	Assisted GPS

CHAPTER 1

INTRODUCTION

1.1 Background of Study

In this modern informatics life, technological advancement has completely revolutionized the world causing humans are too integrates on them in their lifetime especially mobile phone. Moreover, the mobile gadgets are much sophisticated nowadays that is it looks much alike a computer with more compact and tinier but allowing information to be stored on the mobile devices [1]. In addition, a Global Positioning System (GPS) navigator device has been replace by the mobile gadget as well. This is due to the importance of the location information that helps people to search for things or places such as locating they current place and looked for what they want or needed. Therefore, Location-Based Service (LBS) concept is needed to fulfill this problem.

LBS is an information or entertainment service, which is accessible with mobile devices through mobile network and utilizing the ability to make use of the geographical position of the mobile device [2][3][4]. LBS comes with GPS tracking because GPS tracking is a major enabling ingredient, utilizing access to mobile web. Therefore, without the needs of manually specify the location identifier mobile user can still locate their requested location such as stores, restaurants, banks, etc.

1.2 Problem Statement

An automated teller machine (ATM) is a computerized telecommunications device that provides the clients to have financial transactions in public space using non-cash media card without the need of going to the bank. Therefore, people can easily have their transaction done by using the ATM. However, for those who are not familiar with Kuantan area, will found out that they hardly to find an ATM that is nearby to their current location. So, it will bring difficulty in searching for ATM when someone who is out of cash and needed it urgently for emergency use. On the other hand, even if that person has a map that leads them to the location of ATMs that is provided in the travel maps, it is still hardly to get to the accurate location of the ATMs in Kuantan. Stu Fisher, senior vice president of eCommerce at Addison Avenue Federal Credit Union, stated *"Even with more than 300,000 ATMs across the country, finding one when you need it can be a challenge. The visual ATM locator solves this problem and shows people, which ATMs are free vs. fee by looking at the horizon through a mobile device."*. Moreover, people easily get lost if they refer to the unclear road sign to get themselves to their wanted destination. As the result, with a device that can locate the ATMs for different type of banks in Kuantan are in the user's fingertips.

1.3 Objective

The objectives for the ATMs Locator in using GPS on Mobile App are as below:

i. To develop an ATM location tracker using Global Positioning System (GPS) in web-based form that supported in iOS platform.
ii. To locate the nearby ATM location from the user's current position.
iii. To show the ATM location on Google Maps.

1.4 Scope

This proposed system is developed for a mobile application in hybrid apps that is supported in iOS platform. The main purpose of this system is to track the ATM Bank those are available in Kuantan, Malaysia. However, it is limited to around 20 ATM Bank that are available in Kuantan. Besides that, this system can store the previous searching data. In additional, it can calculate the distance from the user's current destination to the nearby ATM Bank. Lastly but not least, this system is developed mainly for general people with the condition they must own an iPhone.

1.5 Thesis Organization

This thesis consists of five chapters ranging from Chapter 1 until Chapter 5. Chapter 1 gives an overview of the study conducted. It also supply with the problem statement, objective and the scope of the study. Meanwhile, Chapter 2 reviews the previous research works that was conducted by other researches. All the relevant technical paper, journals, and books taken from those researches will be discussed in detail. Chapter 3 reveals the techniques and the algorithms that will be used in performing this study. It will discuss about the process flow in detail of this research. Details of the implementation of the study will be discussed in Chapter 4. Results of the testing are to be expounding in Chapter 5 along with conclusion of the entire thesis.

CHAPTER 2

LITERATURE REVIEW

2.1 History of Global Positioning System (GPS)

During prehistoric times, people have been thinking how to get to their destination and back home. Firstly, they marked trails along the way they have used so that they wont lost on the way back home. Later on, they began making maps and developed the use of latitude and longitude as a way of location places during Classical Age of Greece. The navigator determines his latitude by observing the height of the sun during the day and the North Star at night (Boat Safe Kids, 2009). On 13th Century, a mariner's compass – magnetic compass, was the earliest man-made navigation tool. However, it is not much accurate when navigating an unknown area (Boat Safe Kids, 2009). In 1484, a sextant was used to determine latitude by measuring the angle above the horizontal of the sun and stars.

Global Positioning System (GPS) was initiated in 1973, a worldwide radio-navigation system that is formed from a constellation of 24 satellites and the ground stations. It provides location and time information in all weather, anywhere on or above the Earth to within 20 to 30 feet from GPS receiver (Rai, 2010). Australian Government's National Innovation Awareness Strategy stated that there is some weakness in GPS because it is similar to all radio-navigation systems where the signals coming from the satellites are vulnerable to interference accidental by the

electromagnetic interference around communication towers. That's why, sometimes the GPS receiver signal may not strong.

On the other hand, GPS was developed to meet the United State (U.S.) military forces needs. This is because, GPS system has become a new way to use its capabilities in people's everyday life (U.S. Aerospace Corporation, 2005), where consumers use GPS system for two purposes that are positioning and navigation depends on their needs. For example, GPS systems provide some standard and useful information such as the distance traveling, time traveling, speed traveling, maps of the user's trail and etc., which it has become importance to people's lifestyle since it can brings easier lifestyles to everyone.

According to U.S. Aerospace Corporation (2005), GPS systems are fundamentally consists of three elements, which are a constellation of satellites, receiver and ground stations. The following figure shows how the GPS comprises a control, space and user segments.

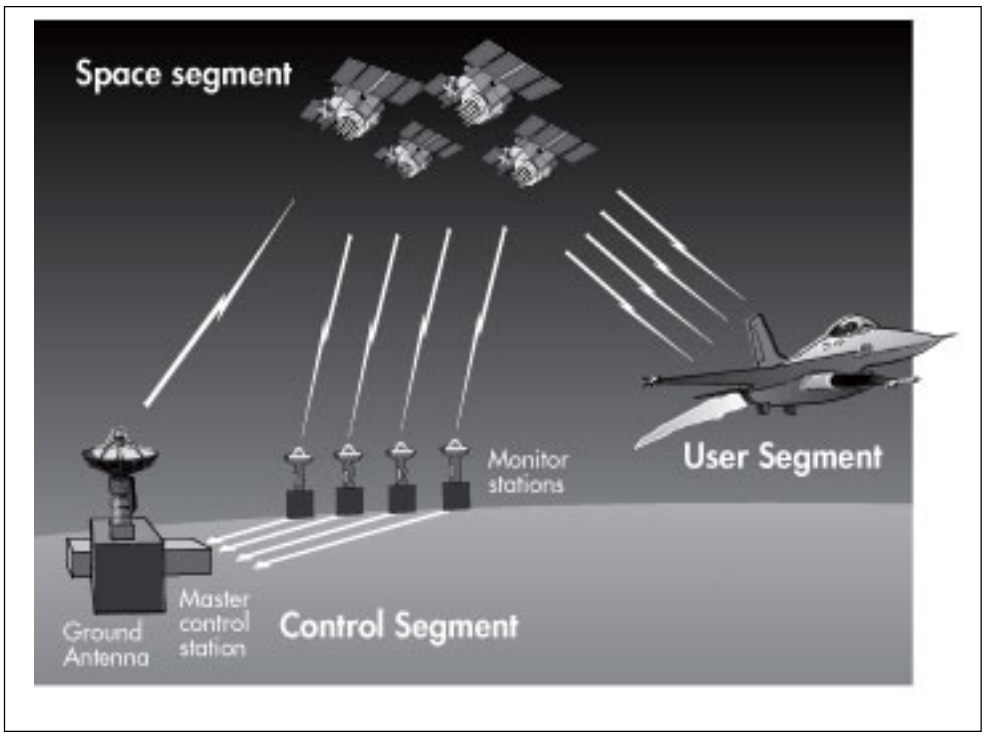

Figure 2.1 GPS comprises a control, space and user segments.
(U.S. Aerospace Corporation, 2007)

2.2 GPS Elements

GPS has three element parts that are the space segment, the user segment and the control segment. The space segment consists of constellation of 24 satellites, each are located in its own orbit 11,000 nautical miles above the Earth which users make ranging measurements. Dorsey, et al. (2006) states that the satellite vehicles (SV) i.e., satellites transmit a pseudorandom noise (PRN) coded signal from which the ranging measurements are made. Unlimited users can simultaneously use GPS because user with signals only being transmitted and the user passively received the signals.

The GPS receiver comprises the user segment where the receivers connected to the satellites all of the time. The receivers are known as passive. They only need to receive "order" from the Space Segment and does not have the ability to broadcast anything. Therefore, it is accessible to unlimited users at the same time without being interfering each other. This view has been supported in the work of Carter (1997). Nowadays, more than a hundreds of receiver models are being use. The most typical hand-receivers are the mobile phone.

Lastly, the control segment consists of six ground stations and is located around the world. The purpose is to make sure the satellites are working properly and track the navigation signals and send their data back to the master control station. This is because the Control Segment updates each of the satellite's clocks, ephemeris and almanac and the navigation signals.

2.2.1 Space Segment Description

It consists of two principal aspects that are the constellation of satellites and the features of the satellites that occupy each orbital slot.

2.2.1.1 GPS Satellite Constellation Description

As discussed in Section 2.2, 24 satellites are positioned in six Earth centered orbital planes. It provides 24 hours global user navigation and time determination capability. The following figure shows the satellites orbits in a planar projection referenced to the epoch time stated by Carter (1997).

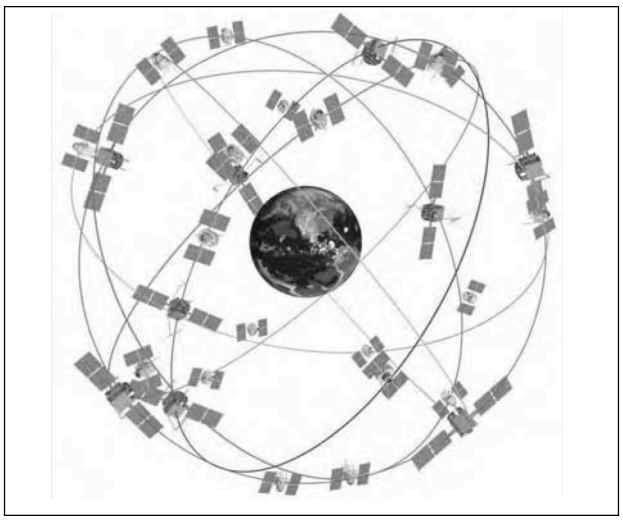

Figure 2.2 GPS satellites constellation. (Source: Lockheed Martin Corp.)

The orbital plane locations with respect to the Earth are defined by the longitude of the ascending node, while anomaly defines the location of the satellites. The longitude is the geographic coordinate that intersects on each orbital plane with the equatorial plane. Meanwhile, anomaly is angular position of each satellite within the orbit, with the Earth's equator as the reference with a zero value.

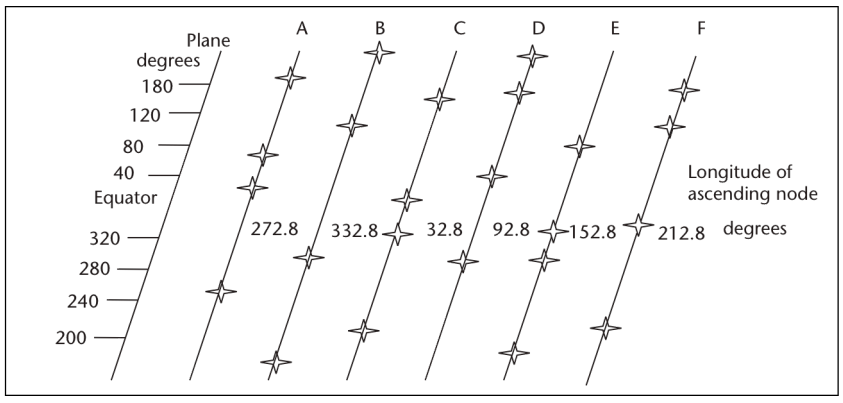

Figure 2.3 GPS constellation planar projection. (Source: Carter, 1997)

2.2.1.2 Constellation Design Guidelines

The geometric sufficiently diverse provides good observe-ability to users throughout the world by measuring its geometric with a parameter called dilution of precision (DOP). Another design consideration is the ground stations to maintain the ephemeris of the satellites and the uploading of data.

2.2.2 User Segment

A GPS receiver processes the L-band signals transmitted from the satellites to determine PVT (Position, Velocity and Time). The following section will discuss on its characteristics.

2.2.2.1 GPS Set Characteristics

The GPS set consists of five principal components, which are antenna, receiver, processor, input/output (I/O) device and power supply.

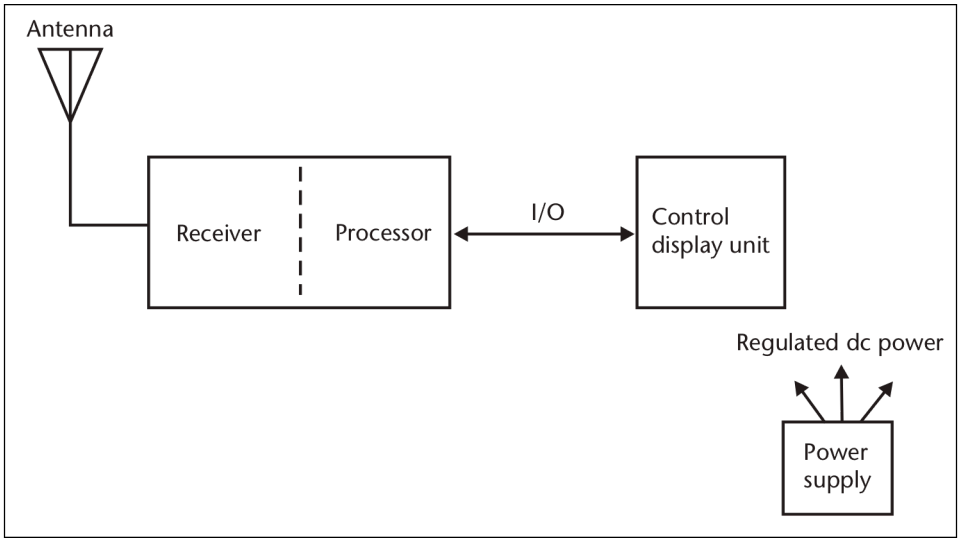

Figure 2.4 Principal GPS receiver components. (Source: Carter, 1997).

The antenna is designed to transfer respond where the position that is computed with GPS receiver is actually is the position of the electrical phase center. Then it detects the electromagnetic signal transmitted by the GPS satellite and converts it to electric current, amplifies the signal strength and sends them to receiver electronics. It. The antenna and receiver front end must have sufficient bandwidth to pass the signals for interest.

GPS receivers designed for use in handheld devices need to be power efficient. These receivers may trade off susceptibility to high-power in-band interferers to achieve minimum power supply drain depending on the implementation (Carter, 1997).

A receiver processor is required to control and command the receiver with channel signal acquisition and by signal tracking and data collection. The processor that refers to the receiver measurements may form the PVT solutions. Most of the processors provide an independent PVT solution on a 1-Hz basis. However, some applications may be dedicated to the computation of both PVT and associated navigation functions. For example, an auto-land aircraft require computation of independent PVT solutions at minimum of 5Hz.

Based on the Figure 2.4, The I/O device is the control display unit interface between GPS set and the user. It allows operator data entry, display status and navigation solution parameters. As for those onboard an aircraft or ship may have the I/O device integrated with existing instruments or panels.

Lastly, the power supply can be integral, external or both. Most receivers have an internal rechargeable Nickel-Cadmium battery in addition to an external power input. The internal battery is use to maintain data stored in volatile random access memory (RAM), integrated circuits (ICs) and to operate a built-in-timepiece when it is not connected to the power.

2.2.3 Control Segment Description

Control segment is the vital link in GPS technology. Its main functions are monitoring and controlling the satellite system continuously, determine GPS system time, predict the satellite ephemeris and the behavior of each satellite clock and update periodically the navigation message for each particular satellite.

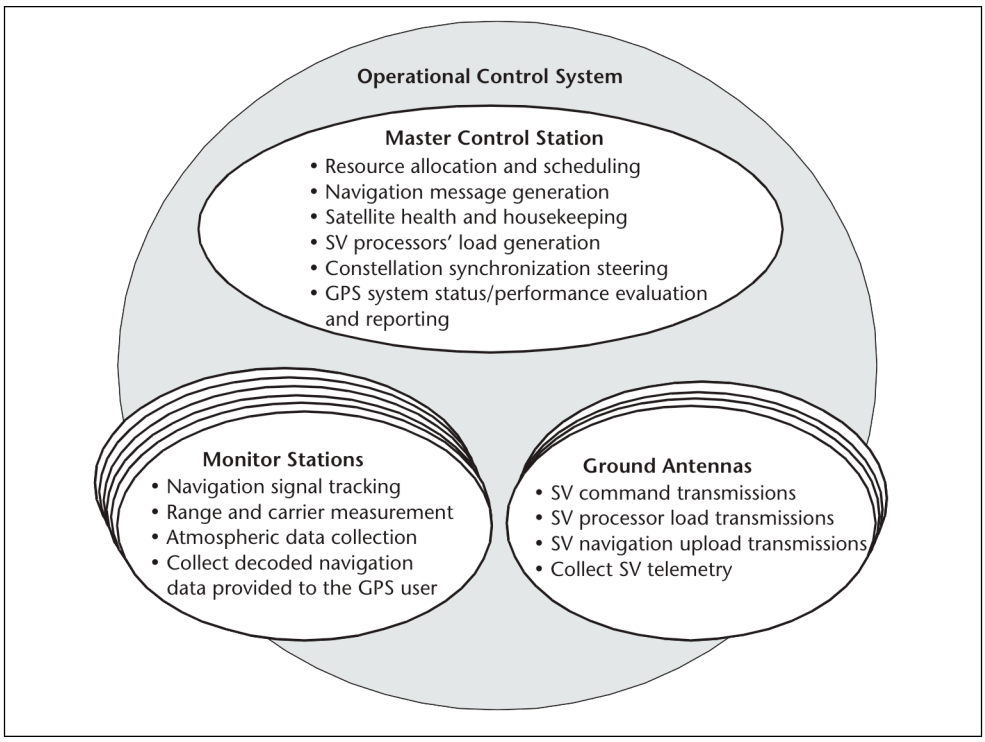

Figure 2.5 Elements in operation control system. (Source: Carter, 1997)

Table 2.1 Comparison of GPS elements. (Source: Raju, Geo-informatics Division, Indian Institute of Remote Sensing, Dehra Dun)

Segment	Input	Function	Output
Space	Navigation message	Generate and transmit code and carrier phases and navigation message	P-Code C/A code L1, L2 carrier Navigation message

Table 2.1 Comparison of GPS elements. (Source: Raju, Geo-informatics Division, Indian Institute of Remote Sensing, Dehra Dun) (continue)

Segment	Input	Function	Output
User	P-Code Observations Time	Produce GPS time predict ephemeris manage space vehicles	Navigation message
Control	Code observation Carrier phase observation navigation message	Navigation solution, surveying solution	PVT (position, velocity and time)

2.3 Advantages and Disadvantages of GPS Systems

In the past, GPS was used by the U.S. Department of Defense to allow the military to navigate under any condition, anywhere in the world. Today, consumers use GPS systems that using the same satellites signals as the military uses. Therefore, consumer GPS devices can offer many significant advantages yet there are a few disadvantages using GPS systems.

GPS has bunch of useful depends on the users' need. For example, it is extremely handy especially for those who like hiking. Consumers can deviate from a path without worrying getting lost on finding their way back. Or, for vehicle drivers, consumers can get themselves to their destination by the turn-by-turn instruction in GPS-based navigation systems. Therefore, it is helpful to those who are unfamiliar to the places that they departed to. It also allows consumers to search the local area for nearby amenities such as; banks, gas station, restaurant etc. by providing the information and the direction of the selected amenity. For boaters, GPS systems can help them to figure out their current position on the maps.

Although GPS systems are helpful in people's living style still, it has a few of failure. The main failure is when the GPS receiver fails to receive updates due to the signals are bounces off of objects, such as tall buildings or large rock surfaces of the area or bad weather. Therefore, consumers need to backup the maps and

direction in case the error occurred. Besides that, GPS signals are not completely accurate. This may occur due to the orbital errors. So, GPS systems do helpful sometimes depending on the surrounding situations.

Table 2.2 Advantages and Disadvantages of GPS systems.

Advantages	Disadvantages
Ease of navigation	Possible failure
Search nearby area	Signal multipath
Water navigation	Inaccuracy

2.4 GPS Services in Mobile Phones

Recently, in the field of activity-travel surveys, positioning technologies such as GPS for mobile communications have been widely applied to collect detailed information on travel trajectory. Nowadays, people can use their cell phones to get direction, track their friends, searching the nearest amenities or keep an eye on their kids. According to Carter (2006), the U.S. FCC (Federal Communications Commission) has mandated the E911 (Enhance 911), which requires that the location of any mobile phone used to call 9-1-1 can be determined. This will require that the manufacturers to install a GPS receiver in all mobile phones. As the result, people able to use their mobile phone to get driving directions.

2.4.1 System Platform

Mobile phone, PDA (personal digital assistant) and laptop PC are possible options of mobile electronic devices for GPS navigation. According to Ohmori, Harata and Nakazoto (2005) research, the laptop PC is the best for respondents to enter activity information in terms of the size of monitor display but less convenient for respondents both to carry and to enter activity information anytime and anyplace. Mobile phone and PDA are smaller devices and easier to be carried. The mobile phone has a smaller monitor and less flexibility for the design of data entry form

than PDA, but the number of mobile phone users is much higher than PDA user in Japan.

Table 2.3 Comparisons among Devices as the GPS Systems Platform.

	Mobile Phone	**PDA**	**Laptop PC**
Size of monitor	Small	Moderate	Large
Easiness to be carried	Easy	Moderate	Difficult
Flexibility for the design of data entry form	Low	Moderate	High
The dissemination in people	High	Low	High

2.4.2 Smartphones with built-in GPS

Naturally, navigation is used on most smartphones since it has full GPS capability onboard with an app that handles the mapping and navigation. There are many options for all smartphone platforms such as iOS (iPhone Operating System), Android, Windows Mobile, and etc. The following sub-sections are the study cases that are use in smartphones nowadays.

2.4.2.1 Maybank ATM and Bank Branch Locator (M2U Map)

This application is a free application that can be downloaded onto iPhone. It is designed to experience mobile banking services, navigate the nearest ATM or branch, and even look out for the best dining treats outlets in both Singapore and Malaysia. However, this application is develop typically only for Maybank customers particularly for those who are using iPhone. M2U Map is a native application, which means it is an application that is developed for iPhone will need to run on iOS platform, or on Symbian for many Nokia devices and etc.